

REMARKS

Claims 17-33 are all the claims pending in this application. Claims 30 and 31 have been amended, and support for the amendments can be found, for example, in original claim 26.

Entry of the above amendments is respectfully requested.

I. Rejection based under 35 U.S.C. § 102 based on Schmutz et al.

Claims 17-22, 26 and 27 have been rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Schmutz et al., U.S. Patent No. 5,470,357 ("Schmutz").

The Examiner asserts that Schmutz discloses obtaining a battery by the same method as Applicants' claimed invention. (see col. 9, lines 15-37). The Examiner further asserts that Schmutz discloses the first and second solid polymer electrolyte ("SPE") films obtained from a polymerizable compound and SPE films with an ionic conductivity at room temperature of between 2×10^{-3} to 9×10^{-5} S/cm. (see col. 4, line 66 to col. 5, line 20, col. 1, lines 62-67, col. 5, lines 23 to 63).

Applicants respectfully respond as follows.

An important technical feature of the present invention relates to fixing a solid polymer electrolyte film to a porous electrode by reducing the pressure inside the porous electrode. As compared with the case where pressure reduction is not conducted, the method of the present invention enables closer contact between the pre-SPE film and the electrode, which results in excellent adhesion between the pre-SPE film and the electrode. In addition, a battery fabricated by impregnating the electrode in electrolytic solution according to the present invention provides excellent properties, such as large capacity in comparison to a battery fabricated without pressure reduction.

Schmutz discloses applying less pressure at column 9, line 32. However, in the fabrication method of Schmutz, a roller-pressing step at 120 °C or higher is required as well as a pressure reduction step. Accordingly, the process of Schmutz is different from the present invention, which does not involve a roll-pressing step with heat.

In addition, the present invention and Schmutz differ in the purpose of pressure reduction. The SPE film of Schmutz, which is a thermoplastic copolymer of PDVF-HFP, is heat-fused at the time of laminating cell elements, and the pressure reduction steps is conducted to effectively impregnate the fused polymer electrode with electrolyte solution. In contrast, in the present invention, since the polymer which the SPE-film consists of is a cross-linking polymer obtained by photo-curing a polymer having a polymerizable functional group, neither a process for impregnating the polymer into the electrode nor a heat-fusing step is necessary.

In view of the above, Schmutz does not teach or suggest the present invention, and withdrawal of the foregoing rejection is respectfully requested.

II. Rejection under 35 U.S.C. § 103 based on Schmutz et al.

Claims 30 and 31 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Schmutz et al., U.S. Patent No. 5,470,357 ("Schmutz").

The Examiner asserts that Schmutz discloses the overall battery set forth in claims 30 and 31, however, the Examiner acknowledges that Schmutz does not specifically disclose a concentration of the electrolyte salt as being greater than a concentration at which the electrolytic solution has a maximum conductivity. The Examiner further asserts that a skilled artisan would have appreciated that the ion conductivity would be increased because Schmutz discloses the introduction of the electrolytic solution into the polymer electrolyte constituent of

the porous electrode composite causing it to swell. (see col. 5, lines 23-52). Therefore, the Examiner concludes that it would have a greater concentration than the electrolytic solution has at its maximum conductivity.

Applicants respectfully respond as follows.

An important feature of the battery of the present invention is that the SPE film is prepared only from an organic solvent (i.e., containing no salt and having no ion conductivity) and is fixed to the electrode. Then, the SPE film is impregnated with an electrolytic solution having a high concentration of electrolytic salt so that the condition of the electrolytic solution may be optimum by dispersing salts in the SPE film, thus obtaining high ion conductivity. Therefore, since the SPE film of the present invention is formed prior to the impregnation with an electrolytic solution, contrary to the Examiner's position, the electrolytic solution does not allow swelling of the polymer electrolyte and would not result in a higher concentration of electrolyte or higher conductivity.

In view of the above, withdrawal of the foregoing rejection is respectfully requested.

III. Rejection under 35 U.S.C. § 103 based on Schmutz et al. in view of Ichino et al.

Claims 23-25, 32 and 33 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Schmutz et al., U.S. Patent No. 5,470,357 ("Schmutz") and Ichino et al., U.S. Patent No. 5,858,264 ("Ichino").

The Examiner asserts that Schmutz discloses that the SPE film is formed from a polymerizable compound and that the SPE films are impregnated with an electrolytic solution by immersion. However, the Examiner acknowledges that Schmutz does not specifically disclose

that the SPE film contains a cross-linking polymer having a urethane bond and an oxyalkylene group (claims 23-25) or that the SPE film is compounded with an electrolyte salt prior to being polymerized to form the SPE film (claims 32-33).

The Examiner asserts that in view of Ichino it would have been obvious to one of ordinary skill in the art at the time of the invention to substitute the VdF:HFP copolymer disclosed by Schmutz with a cross-linking polymer having a urethane bond and an oxyalkylene group. (see col. 4, lines 29-59).

Likewise, the Examiner asserts that in view of Ichino it would also have been obvious to one of ordinary skill in the art at the time of the invention to utilize a SPE film in the method of Schmutz and compound with an electrolyte salt prior to being polymerized to form the SPE film. (see col. 5, lines 1-22).

Applicants respectfully respond as follows.

It is respectfully submitted that the present invention according to claims 23-25, 32 and 33 are not taught or suggested by Schmutz for the same reasons as above.

In addition, one of ordinary skill in the art would not have been motivated to combine Schmutz and Ichino to arrive at the present invention. Ichino discloses a cross-linking SPE which is a composite of a polymer having a polymerizable group such as acrylate. However, it would not have been obvious to one of ordinary skill in the art to substitute VdF:HFP copolymer (Schmutz) with a cross-linking polymer having a urethane bond and an oxyalkylene group based on the disclosure of Ichino.

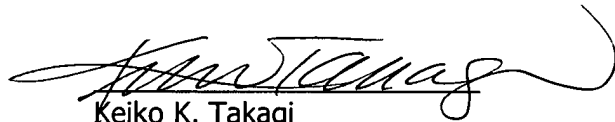
In view of the above, Schmutz and Ichino do not teach or suggest the present invention, and withdrawal of the foregoing rejection is respectfully requested.

IV. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,


Keiko K. Takagi
Registration No. 47,121

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

23373

CUSTOMER NUMBER

Date: January 27, 2004